REMARKS

By this amendment, claims 1-4 and 28 have been cancelled, claims 5, 7, 23, 25, 27-29, 31, have been amended, and 41-44 have been added. Accordingly, claims 5-27 and 29-44 are pending in the present application. In particular, claims 36-39 have been amended to correct an error in the claim numbering, a reason unrelated to the patentability of the claims. The claim amendments are supported by the specification, the accompanying figures, and claims as originally filed, with no new matter being added. Accordingly, favorable reconsideration of the pending claims is respectfully requested.

1. Rejections Under 35 U.S.C. §112

Claim 23 has been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. In particular, the Examiner has stated that claim 23 recites the term "polymer forming gas" without providing antecedent basis for the term in claim 5. Applicants respectively traverse.

Applicants have amended claim 23 to remove the term "polymer forming" so that only the term "gas" is now recited. Accordingly, Applicants believe that the presently recited term has antecedent basis in claim 5, and Applicants therefore respectfully request that the rejection of claim 23 under 35 U.S.C. § 112, second paragraph, be withdrawn.

2. Rejections Under 35 U.S.C. §102

Claims 1, 3, 5-9, 11-12, 17, and 19-24 have been rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 5,368,685 to Kumihashi et al. (hereinafter "*Kumihashi*") for the reasons set forth on pages 2-4 of the Office Action. Applicants respectfully traverse.

Claim 5 has been amended to recite:

> wherein the pulsing provides for the alternating steps of:
> etching said microelelectronics substrate with said at least one gas;
> and
> forming a deposit with said at least one gas on a vertical surface of the microelectronics substrate, the deposit preventing additional etching of the vertical surface of said microelelectronics substrate underneath the deposit.

Accordingly, the invention as recited in present claim 5 is directed to the pulsing of at least one gas to provide for the alternate steps of etching and forming a deposit that prevents additional etching.

Kumihashi has no such teaching. Rather, *Kumihashi* disclose the use of chlorine and oxygen gasses that are pulsed in an alternating fashion. Accordingly, the prompt removal of the rejection of claims 5-9, 11-12, 17, and 19-24 under 35 U.S.C. § 102(b) is respectfully requested.

Claim 7 depends from claim 5 and is patentable over the cited reference for at least the reasons presented hereinabove with respect to claim 5. In addition, claim 7 has been amended to remove the term "polysilicon" and recite "wherein said substrate is selected from the group consisting of an oxide film, a resist, a multi-layer resist, a metal, a metal alloy, an aluminum alloy, a refractory metal, tungsten, an electrical conductor, and at least one polysilicide." *Kumihashi* does not disclose a method for controlling etch profile for these substrates.

Claim 9 depends from claim 5 and is patentable over the cited reference for at least the reasons presented hereinabove with respect to claim 5. In addition, with regard to claim 9, *Kumihashi* teaches pulsing wherein the concentration within the etch chamber reaches steady state at least once in a give plurality of periods. *See*, *Kumihashi*, Figures 7 and 8. This steady state period is depicted as the period of time when the pulse is level either at its maximum or minimum.

In contrast, Figures 12A and 12B of the present application illustrate non-steady state pulsing. As stated in the specification in the paragraph beginning at page 25, line 21:

> The solid lines in Figs. 12A and 12B do not superimpose with the respective dashed lines. This feature indicates that under these pulsing conditions the medium within the chamber does not reach steady state conditions. As shown by the solid lines in Figs. 12A and 12B, the transition time between state 1 and state 2 conditions is a significant fraction of the period, and the chamber operates under non steady state conditions for approximately all the time. Figures 12A and 12B illustrate an example of fast pulsing conditions in an embodiment of the present invention in which the system does not reach steady state conditions for any of the states 1 or 2.

Therefore, a careful readying of present claim 9 reveals what is taught in the specification, that the pulsing operates so that the gas does not reach steady state conditions since "the chamber operates under non steady state conditions for approximately all the time." *Id.* Thus, the limitation of claim 9 regarding non-steady state conditions is not taught or suggested by *Kumihashi*, and the prompt removal of the rejection of claim 9 is therefore respectfully requested.

Regarding claim 19, claim 19 depends from claim 18, which has not been rejected under 35 U.S.C. § 102(b). Accordingly, the prompt removal of the rejection of claim 19 under 35 U.S.C. § 102(b)is respectfully requested.

Claim 22 depends from claim 5 and is patentable over the cited reference for at least the reasons presented hereinabove with respect to claim 5. In addition, Applicants respectfully disagree with the Examiner's rejection of claim 22. Applicants note that claim 22 depends from claim 17, and therefore contains the limitations therein. Because claim 17 recites "patterning a layered substrate with a photoresist mask," the oxide layer recited by claim 22 is clearly a part of a layered substrate while the photoresist layer is not. Therefore, any minor etching of SiO_2 mask 36 in *Kumihashi* has no bearing on the recited etching of an oxide layer that is part of a layered substrate, as presently recited. Accordingly, the prompt removal of the rejection of claim 22 under 35 U.S.C. § 102(b) is respectfully requested.

Claim 23 depends from claim 5 and is patentable over the cited reference for at least the

reasons presented hereinabove with respect to claim 5. In addition, claim 23 has been amended to recite "the protective layer comprises a polymer." Kumihashi does not disclose such a limitation. Accordingly, the prompt removal of the rejection of claim 23 under 35 U.S.C. § 102(b) is respectfully requested.

Claims 35, 38, and 39 have been rejected under 35 U.S.C. § 102 as being anticipated by U.S. *Kumihashi* for the reasons set forth on page 4 of the Office Action. Applicants respectfully traverse.

Claim 35 has been amended to recite: "at least one of said gases comprises a polymer forming gas for depositing a protective layer." Therefore, because Kumihashi does not disclose a polymer forming gas for depositing a protective layer, the prompt removal of the rejection of claims 35, 38, and 39 under 35 U.S.C. § 102(b) is respectfully requested.

Accordingly, Applicant therefore respectfully requests that the rejection of the claims under 35 U.S.C. § 102(b) be withdrawn.

2. Rejections Under 35 U.S.C. §103

Claims 2, 10, 13, 14, 16, 18, and 25-26 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Kumihashi* for the reasons set forth on pages 4-5 of the Office Action. Applicants respectfully traverse.

The limitations of present claim 5, as discussed hereinabove, are not taught or suggested by *Kumihashi*. Claims 2, 10, 13, 14, 16, 18, and 25-26 depend from claim 1 and include the limitations thereof. Therefore, claims 2, 10, 13, 14, 16, 18, and 25-26 are patentable over *Kumihashi* for at least by reason of the limitations of claim 5.

Claims 4 and 15 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Kumihashi* in view of U.S. Patent No. 6,287,980 to Hanazaki et al. (hereinafter ("*Hanazaki*") for the

reasons set forth on pages 5-6 of the Office Action. Applicants respectfully traverse.

Claim 4 has been cancelled. Claim 15 depends from independent claim 5 and contains the limitations thereof, including the recitation of at least one gas to provide for the alternate steps of etching and forming a deposit that prevents additional etching. *Hanazaki* does not overcome this deficiency of *Kumihashi*. Rather, like *Kumihashi*, *Hanazaki* relates to the use of multiple gasses to obtain a desired etch profile. Therefore, Applicants respectively assert that claim 15 is patentable over the cited references for at least the reasons presented hereinabove with respect to claim 5, and the prompt removal of this rejection is respectfully requested.

Claims 27-30 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Hanazaki* in view of U.S. Patent No. 5,439,978 to Lu et al. (hereinafter "*Lu*") for the reasons set forth on pages 6-7 of the Office Action. Applicants respectfully traverse.

Claim 27 has been amended to recite the step of "providing a hydrofluorocarbon gas." Claim 27 therefore now recites the use of dual gasses: a pulsed fluorocarbon gas and a hydrofluorocarbon gas, which may or may not be pulsed. Neither of *Hanazaki* and *Lu* disclose such a feature of the invention. Rather, while *Hanazaki* discloses both fluorocarbon and hydrofluorocarbon gasses, neither cited reference discloses their simultaneous use. Therefore, claims 27-30 are patentable over *Kumihashi* for at least by reason of the limitations of claim 5.

Claims 31-34, 36, and 37 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Hanazaki* for the reasons set forth on pages 7-8 of the Office Action. Applicants respectfully traverse.

Claim 31 has been amended to recite "etching said microelelectronics substrate with said a second [at least one] gas during said pulsing." The second gas is selected from the group consisting of a polymer forming gas, a polymer etching gas, and a fluorocarbon. The particular gasses recited

with respect to the at least one gas suitable for forming a deposit has also been amended to recite the genus of gasses a halogenated hydrocarbon and a fluorocarbon." *Hanazaki* does not teach or suggest the use of these recited materials for forming a deposit on a substrate and etching a substrate. Accordingly, Applicants therefore respectfully request that the rejection of the claims under 35 U.S.C. § 103(a) be withdrawn.

4. New Claims

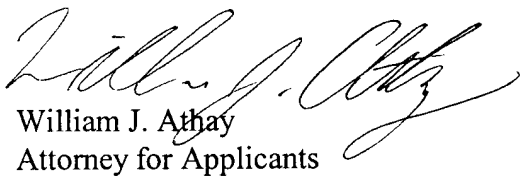
Newly added independent claim 41 has been added to recite additional features of the invention, including "pulsing into said etch chamber a carbon containing polymer gas suitable for: forming a deposit on at least a portion of said microelectronics substrate; and etching said microelelectronics substrate." In addition, dependent claims 42-44 depend directly or indirectly from claim 5 and have been added to recite additional features of the invention that are not taught or suggested by the cited references. The prompt allowance of these claims is therefore respectfully requested.

CONCLUSION

In view of the foregoing, Applicants respectfully request favorable reconsideration and allowance of the present claims. In the event the Examiner finds any remaining impediment to the prompt allowance of this application that could be clarified by a telephone interview, the Examiner is respectfully requested to contact the undersigned attorney.

Dated this 8th day of April 2002.

Respectfully submitted,



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VERSION WITH MARKINGS SHOWING THE CHANGES MADE

In the claims:

Claims 5, 7, 23, 25, 27-29, 31, and 34-39 have been amended as follows:

5. (Once Amended) A method to control etch profile while etching a microelectronics substrate, the method comprising:

providing an etch chamber and a microelectronics substrate disposed therein; and

pulsing into said etch chamber at least one gas [suitable for forming a deposit on at least a portion of said microelectronics substrate,] wherein said pulsing imparts a time varying flow rate to said gas for a plurality of periods of said time varying flow rate; [and] wherein the pulsing provides for the alternating steps of:

etching said microelelectronics substrate with said at least one gas; and

forming a deposit with said at least one gas on a side surface of the microelectronics substrate, the deposit preventing additional etching of the side surface of said microelelectronics substrate underneath the deposit.

7. (Once Amended) The method as defined in Claim 5, wherein said substrate is selected from the group consisting of an oxide film, a resist, a multi-layer resist, a metal, a metal alloy, an aluminum alloy, a refractory metal, tungsten, an electrical conductor, [polysilicon,] and at least one polysilicide.

23. (Once Amended) The method as defined in Claim 5, wherein:

said [etching] gas is a protective layer forming gas, wherein the protective layer comprises a polymer;

said microelectronics substrate has at least an oxide layer; and

said [polymer forming] gas selectively removes at least a portion of said oxide layer and a vertical profile in said oxide layer.

25. (Once Amended) The method as defined in Claim 41[5], wherein said microelectronics structure includes a nitride layer.

27. (Once Amended) A method of etching oxide using a polymer, the method comprising:

disposing a patterned semiconductor substrate in a high density plasma etcher, said substrate comprising a silicon layer with a gate stack structure disposed thereon, said gate stack structure being encapsulated by silicon nitride, and layered with an oxide;

selectively removing portions of said oxide by pulsing a fluorocarbon gas;[,] wherein:

said pulsing imparts a time varying flow rate to said fluorocarbon gas for a plurality of periods of said time varying flow rate; and

said fluorocarbon gas forms a protective layer; and

providing a hydrofluorocarbon gas [removing said polymer].

28. (Once Amended) The method as defined in Claim 27, wherein said [protective layer is removed with a] hydrofluorocarbon gas is pulsed into the plasma etcher so that the hydrofluorocarbon pulses alternate with the fluorocarbon gas pulses.

29. (Once Amended) The method as defined in Claim 27 [28], wherein said hydrofluorocarbon gas is pulsed into said high density etcher, wherein pulsing said hydrofluorocarbon gas imparts a time varying flow rate to said hydrofluorocarbon gas for a plurality of periods of said time varying flow rate.

31. (Once Amended) A etching method comprising:

forming a photoresist pattern on a microelectronics substrate that includes both an oxide layer and a nitride layer disposed on a silicon layer;

providing an etch chamber and said microelectronics substrate disposed therein;

pulsing into said etch chamber at least one gas suitable for forming a deposit on at least a portion of said microelectronics substrate, wherein:

said deposit is selected from the group consisting of an oxide film, a resist, a multi-layer resist, a metal, a metal alloy, an aluminum alloy, a refractory metal, tungsten, an electrical conductor, polysilicon, and at least one polysilicide;

said at least one gas comprises a gas selected from the group consisting of [CHF3, CH2F2,] a halogenated hydrocarbon, [a hydrofluorocarbon, CO, CO_2, O_2, Ar,] and a fluorocarbon[, CF_4, C4F8, C5F8, BCl_3, Cl_2];

said pulsing imparts a time varying flow rate to said gas for a plurality of periods of said time varying flow rate;

said pulsing is applied at a duty cycle range selected from the group consisting of:

from about 20% to about 80% duty cycle;

from about 30% to about 70% duty cycle; and

from about 40% to about 60% duty cycle;

said time varying flow rate varies within a range selected from the group consisting of:

between a high flow rate value of about 30 sccm to a low flow rate value of about 15 sccm;

between a high flow rate value of about 27 sccm to a low flow rate value of about 18 sccm;

between a high flow rate value of about 25 sccm to a low flow rate value of about 20 sccm;

between a high flow rate value of about 20 sccm to a low flow rate value of about 30 sccm; and

between a high flow rate value of about 15 sccm to a low flow rate value of about 20 sccm;

etching said microelelectronics substrate with said a second [at least one] gas during said pulsing, wherein:

said etching halts on said silicon layer;

said second [etchant] gas is selected from the group consisting of a polymer forming gas, a polymer etching gas, and a fluorocarbon;

said second [etchant] gas selectively removes at least a portion of said oxide layer.

34. (Once Amended) The method as defined in Claim 31, further comprising flowing a [second] gas comprising at least one of the gases nitrogen, oxygen and an inert gas into said etch chamber.

35. Once Amended) An etching method comprising:

exposing a substrate to a plurality of gases, wherein at least one of said gases is pulsed and said pulsing imparts a time varying flow rate to said at least one gas for a plurality of periods of said time varying flow rate; and wherein

at least one of said gases comprises an etchant gas; and

at least one of said gases comprises a polymer forming gas for depositing a protective layer.

37[36]. Once Amended) The method as defined in Claim 35, wherein said etchant gas comprises one gas selected from the group consisting of a hydrofluorocarbon and a fluorocarbon.

38[37]. Once Amended) The method as defined in Claim 35, wherein said gas for depositing a protective layer comprises one gas for depositing a polymer.

39[38]. Once Amended) The method as defined in Claim 36, wherein said gas that modifies the deposition of a protective layer is selected from the group consisting of CO, CO_2, and O_2.

40[39]. Once Amended) The method as defined in Claim 36, wherein said etch modifying gas is selected from the group consisting of BCl_3 and Cl_2.

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